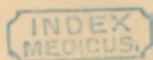


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Burnett (Swan M.)



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OBJECTIVE AURAL SOUNDS PRODUCED BY
VOLUNTARY CONTRACTION OF THE
TUBAL MUSCLES.

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MR. A. P. L., 44 years of age, has possessed the power of producing a certain sound referable to the ears since his early childhood. He was not aware of such a power being unusual, until he called my attention to it accidentally some weeks ago, when under my care for some trouble in the right ear. The sound is produced by a voluntary muscular contraction in the throat. He says it appears to start from this region, and travel outward through the ears.

The sound, which is a fine mucous râle, and similar to the rubbing of the thumb and finger nails obliquely across each other, as suggested by Dr. Holmes in his paper in the last number of these ARCHIVES, can be heard in the *R.* ear at a distance of 50 *cm.*, and is clearest, I think, just on a line with the meatus. It is not heard on the left side at quite so great a distance. It can also be heard in front of the open mouth, also at about 50 *cm.* For the past few weeks he has been performing, under my direction, the experiment of Valsalva, and he finds that when he makes this muscular contraction in his throat at the time of forcible expiration, the air enters the drum cavity with much greater readiness. In fact, he has become able to force a small stream of air into the middle ear of the right side, by simply closing his mouth and making an expiratory effort at the same time that he produces the contraction in his throat. On the other hand, when the middle ear is filled with air, by making the contraction, it passes out into the throat. The contraction takes place on both sides simultaneously as a rule, though, occasionally, it appears on

one side a little in advance of the other. He has not the power to produce it on each side separately.

I watched the M.T.T. during the movement, and could not notice that the position of the malleus was in the least altered. I therefore infer that the tensor tympani does not participate in the contraction.

My friend, Dr. F. Hyatt, an expert laryngoscopist, was kind enough to examine for me the pharynx during these contractive movements. I also myself saw the movements in the laryngoscopic mirror with great distinctness.

During the contraction the anterior wall of the pharyngeal orifice of the tube remains perfectly stationary, while the posterior lip is moved obliquely forward and upward across the mouth of the tube, the edge sometimes reaching to the anterior border, completely closing it, but usually going only about two-thirds of the distance across. The uvula is, at the same time, drawn upward. In a large number of observations, carried through several days, these movements never varied in their character. The mouth of the tube was in a perfectly normal condition. It may also be stated that this gentleman possesses the power of contracting his aural muscles, particularly the *retrahens aurem*.

This case is instructive, in the first place, in that it shows that the objective aural sounds are not produced by a contraction of the tensor tympani, as was supposed by Dr. Holmes. The movement of the M. T. observed in his case, can be accounted for, I think, by the thinness of the membrane which allowed it to be easily affected by the alteration in density of the air in the drum cavity which is the natural result of the suction movement produced by the contraction.

I think the sound is caused by a separation of the moist surfaces of the mouth of the tube after they have been brought together by the contraction of the levator palati. This sound is carried by the substance of the tube, or the air contained in it, to the terminal expansion of the auditory nerve by way of the drum, and is thence projected outward.* The great value of the observation, however, lies in the

* During the act of swallowing, if one will observe, a sort of crackling noise will be heard in the ears. This is, in my opinion, produced by the same cause as the sounds heard in this case, namely, by the separation of the lips of the mouth of the tube.

light which it throws on the action of the muscles of the Eustachian tube.

It has always been supposed that the action of the levator palati was to draw the floor of the tube upward, the mouth being thus shortened and widened. The tensor palati, acting at the same time, was thought to separate the walls of the tube and thus open the way from the pharynx to the cavity of the drum.

Our observation seems to negative this view altogether. During the contraction of the levator palati there is no shortening and widening of the tubal aperture, but on the contrary a closure more or less complete of the pharyngeal orifice, and even after the relaxation of the muscle there is no observable opening of the tube due to the contraction of the tensorpalati. These observations are very similar to those made by Lucæ and reported by him in recent numbers of Virchow's Archives, on some persons in whom the nasal cartilages had been destroyed by lupus, leaving the pharyngeal orifices of the tubes exposed to view during deglutition and phonation. He thinks that if the tube is opened at all it is by an internal dilatation simultaneous with closure of the external orifice, due to simple mechanical inflation or action of the tensorpalati.

In our case we have, in all probability, the same action of the tubal muscles as in the act of deglutition, since the contraction very much facilitates the entrance and exit of air from the cavity of the tympanum.

Therefore, while it is now demonstrated that the mouth of the Eustachian tube is not opened, but closed by the action of the levator palati, the question of how it is opened, if *at all*, is not clearly shown. It is evident, however, that the permeability of the tube is increased, and the most plausible explanation is that of Lucæ given above. The emptying of the tympanum of air by swallowing I would consider satisfactorily explained on the principle of suction, the separation of the lips of the tube being affected in such a manner as to draw the air from the drum cavity down into the throat.

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